Patent claims

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1. Structured surface having ultraphobic properties, characterized in that it has a surface topography in which the value of the integral of a function S

$$S(\log f) = a(f) \cdot f \qquad (1),$$

which gives a relationship between the spatial frequencies f of the individual Fourier components and their amplitudes a(f), is at least 0.5 between the integration limits $\log(f_1/\mu m^{-1}) = -3$ and $\log(f_2/\mu m^{-1}) = 3$, and consists of a hydrophobic or, in particular, oleophobic material, or is coated with a hydrophobic or, in particular, oleophobic material.

2. Surface according to Claim 1, characterized in that the integral is > 0.6.

3. Ultraphobic surface according to Claim 1 or 2, characterized in that it has a contact angle of at least 150° and a roll-off angle of < 10°.

4. Ultraphobic surface according to one of Claims 1 to 3, characterized in that it has a contact angle of at least 155°.

5. Ultraphobic surface according to one of Claims 1 to 4, characterized in that it consists of metal or plastic.

6. Ultraphobic surface according to Claim 5, characterized in that the metal is chosen from the series beryllium, magnesium, scandium, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, aluminium, gallium, yttrium, zirconium, niobium, molybdenum, technetium, ruthenium, rhenium, palladium, silver, cadmium, indium, tin, lanthanum, cerium, praseodymium, neodymium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, lutetium, hafnium, tantalum, tungsten, rhenium, osmium, iridium, platinum, gold, thallium, lead, bismuth, in particular titanium, aluminium, magnesium and nickel or an alloy of said

metals.

7. Ultraphobic surface according to Claim 5, characterized in that the metal is an aluminium-magnesium alloy, in particular $AlMg_3$.

8. Ultraphobic surface according to Claim 5, characterized in that the plastic is a thermosetting or thermoplastic polymer.

9. Ultraphobic surface according to Claim 8, characterized in that the thermosetting polymer is chosen from the series: diallyl phthalate resin, epoxy resin, urea-formaldehyde resin, melamine-formaldehyde resin, melamine-phenol-formaldehyde resin, phenol-formaldehyde resin, polyimide, silicone rubber and unsaturated polyester resin, and the thermoplastic polymer is chosen from the series: thermoplastic polyolefin, e.g. polypropylene or polyethylene, polycarbonate, polyester carbonate, polyester (e.g. PBT or PET), polystyrene, styrene copolymer, SAN resin, rubber-containing styrene graft copolymer, e.g. ABS polymer, polyamide, polyurethane, polyphenylene sulphide, polyvinyl chloride or any possible mixtures of said polymers.

10. Ultraphobic surface according to one of Claims 1 to 9, characterized in that the surface has a coating with a hydrophobic phobicization auxiliary, in particular an anionic, cationic, amphoteric or nonionic, interface-active compound.

11. Material or construction material having an ultraphobic surface according to one of Claims 1 to 10.

12. Use of the ultraphobic surface according to one of Claims 1 to 10 for the friction-reducing lining of vehicle bodies, aircraft fuselages or hulls of ships.

13. Use of the ultraphobic surface according to one of Claims 1 to 10 as self-cleaning coating or panelling of building structures, roofs, windows, ceramic

construction material, e.g. for sanitary installations, household appliances.

14. Use of the ultraphobic surface according to one of Claims 1 to 10 as an antirust coating of metal objects.

15. Use of the ultraphobic surface according to one of Claims 1 to 10 as a transparent sheet or as a topcoat of transparent sheets, in particular glass or plastic sheets, in particular for solar cells, vehicles or greenhouses.

16. Process for the preparation of a surface having ultraphobic properties according to one of Claims 1 to 10, based on an $AlMg_3$ alloy, characterized in that the surface is cleaned, pickled, anodically oxidized, passivated in boiling water, optionally coated with a noble metal as adhesion promoter, in particular with gold with a layer thickness of from 10 to 100 nm, in particular by atomization, and coated with a hydrophobic material, in particular with an anionic, cationic, amphoteric or nonionic, interface-active compound as phobicization auxiliary.

17. Process for the preparation of a surface having ultraphobic properties by moulding, characterized in that a mould, which has the negative of a surface topography suitable for an ultraphobic surface, is moulded with a mixture of a plastic and a hydrophobic or, in particular, oleophobic additive, which separates out upon curing as a thin film between the surface of the mould and the plastic moulding.

18. Process for the preparation of a surface having ultraphobic properties by moulding, characterized in that the surface of a positive mould, which has a surface structure suitable for an ultraphobic surface, is moulded with a plastic, in particular a thermosetting or thermoplastic polymer, and the surface of the resulting moulding having the negative impression of the surface of the positive mould is optionally provided with an adhesion promoter layer and then with a hydrophobic or, in particular, oleophobic coating.

19. Process according to Claim 18, characterized in that the polymer used is a hydrophobic polymer, preferably poly(methyl methacrylate-co-perfluorooctadecyl methacrylate), and the additional coating with hydrophobic or oleophobic material is optionally omitted.

20. Process according to Claim 17 or 18, characterized in that the mould used is the negative or positive of the surface structure of a pickled, anodized surface comprising essentially aluminium or an aluminium alloy and treated with hot water at from 50 to 100°C.

21. Process according to Claim 17 or 18, characterized in that the mould used is the negative or positive of the surface structure of a microstructured, anodized, calcined surface comprising essentially aluminium or an aluminium alloy.

22. Process according to one of Claims 17 to 21, characterized in that the plastic used for the moulding is a thermosetting polymer or a thermoplastic polymer.

23. Process according to Claim 22, characterized in that the thermosetting polymer is chosen from the series: diallyl phthalate resin, epoxy resin, urea-formaldehyde resin, melamine-formaldehyde resin, melamine-phenol-formaldehyde resin, phenol-formaldehyde resin, polyimide, silicone rubber and unsaturated polyester resin.

24. Process according to Claim 22, characterized in that the thermoplastic polymer is chosen from the series: thermoplastic polyolefin, e.g. polypropylene or polyethylene, polycarbonate, polyester carbonate, polyester (e.g. PBT or PET), polystyrene, styrene copolymer, SAN resin, rubber-containing styrene graft copolymer, e.g. ABS polymer, polyamide, polyurethane, polyphenylene sulphide, polyvinyl chloride or any possible mixtures of said polymers.

25. Process according to one of Claims 17 to 24, characterized in that the surface of the moulding with the impression has a coating with a hydrophobic phobicization auxiliary, in particular an anionic, cationic, amphoteric or nonionic, interface-active compound, or such a phobicization auxiliary which hydrophobicizes the surface is used as additive to polymers compatible therewith.

26. Method of testing surfaces for ultraphobic properties, characterized in that the surface is coated, in particular by vapour deposition, with a noble metal or GaAs as adhesion promoter, in particular with gold, in particular in a layer thickness of from 10 to 100 nm, is coated with a phobicization auxiliary, preferably with decanethiol, then the surface topography is analysed, in particular using a combination of scanning tunnelling microscopy, scanning atomic force microscopy, white light interferometry and, from the measured data, the spatial frequencies f and their structure amplitudes a(f), and the integral of the function S

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calculated between the integration limits $\log(f_1/\mu m^{-1}) = -3$ and $\log(f_2/\mu m^{-1}) = 3$ is formed.

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